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S.NO. 669  
SAN JUAN CARRIERS  
D/W 67,500 LT  
ORE/OIL CARRIER  
ELECTRICAL SPECIFICATION

for SAN JUAN CARRIERS, LTD.

mitsui SHIPBUILDING &  
ENGINEERING CO., LTD.

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Date SEP. - 8. 1961

Date SEP. - 8. 1961

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San Francisco



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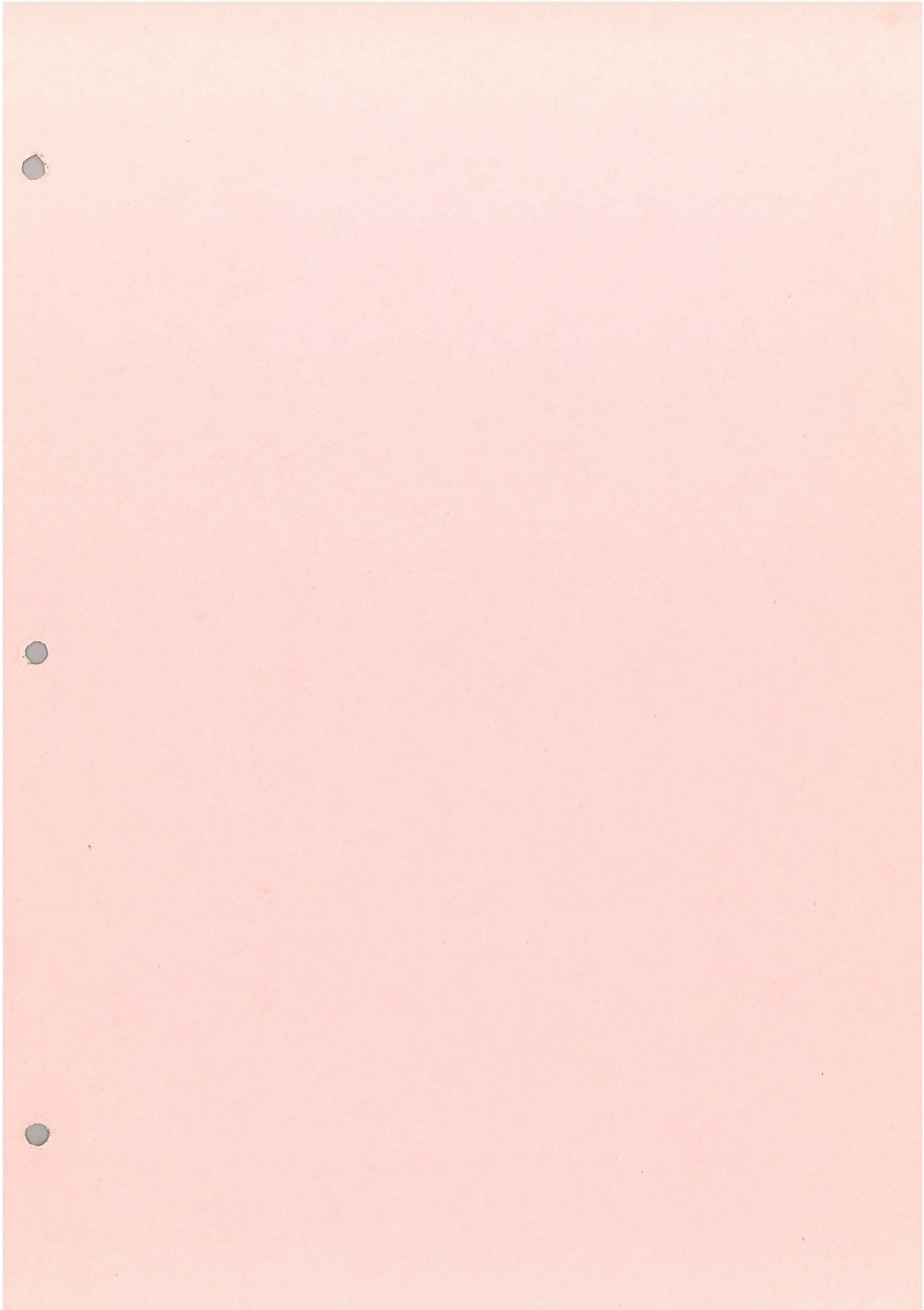


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## SECTION I ELECTRICAL SYSTEMS

### 1.1. GENERAL

The whole of the electrical equipment and installation to be complied with requirements of the following rules or regulations:

American Bureau of Shipping

International Tele-Communication and Radio Regulation  
(Atlantic City 1947)

International Conference of Safety of Life at Sea (1948)  
Rules and Regulations covering Navigation of the  
Panama Canal and Adjacent Waters

Suez Maritime Canal Rules of Navigation.

Further, the same to comply with the general conditions mentioned in this specification as well as Hull and Machinery Specifications, unless otherwise specified or approved.

The Builder to prepare in detail, electrical plans and data as required by and to the approval of the regulatory bodies and Owner's Representative.

In future, when the Shipyard has proposals for alteration from the original electrical specifications or other conclusions which were settled between the Owners and the Shipyard, necessary drawings showing the altered parts with clear notification to be submitted for the Owners' approval. In such case, if the drawings are approved by the Owners, no letters to be submitted by the Shipyard to confirm the Owners' approval concerning the proposals.

The primary power system for the vessel shall be 450 volt, 3 phase, 3 wire, 60 cycle a.c., and the nominal supply



voltage at terminals of power consuming equipment served shall be generally considered to be 440 volt and 115 V, also 22 volts direct current type for special purposes.

The power circuits in general, shall operate on 440 volt, 3 phase, except as otherwise specified for special services and for certain appliances and fractional horsepower motors.

Miscellaneous items of power consuming equipment located remote from convenient connection to a power distribution panel may be connected to a lighting panel board through a separate circuit, when approved, provided such circuits are not rated in excess of 30 amperes.

The ship's normal lighting system and inter-communication and electronic systems shall operate on a nominal voltage of 115 volts.

The General Alarm, Emergency Lights, Call Bell System, and some parts of Engineers' Alarm, shall operate on a nominal voltage of 24 volts (supplied from 24 volt batteries).

All workmanship and materials to prove satisfactory for the requirements of American Bureau of Shipping.

All material and equipment shall be purchased in Japan. Such equipment and materials shall be new and of the Marine type. Equipment shall be installed so as to be readily accessible for repair and removal.

Waterproof metal enclosed equipment and lead or impervious sheathed wiring shall be used in all locations subject to condensation of vapors and in locations either temporarily or permanently exposed to the weather.

All ferrous materials or parts of equipment subject to corrosion by the elements, shall be galvanized after all



fabrication work has been completed.

Dustproof enclosures shall be provided for electrical equipment in locations subject to injury of ore dust. Dripproof protection unless otherwise specified for special locations, shall be provided for all other equipment whether individually enclosed or assembled on open panels. Electrically rotating machinery shall be provided with rodent proof screens in all openings not otherwise covered.

The maximum allowable temperature rise on any equipment or wiring shall be in accordance with applicable regulations and, in general, to be based on an ambient temperature of 50°C, in machinery space, open deck, and 40°C in all other locations.

Equipment, which may have to be located in space of ambient temperatures in excess of 50°C, to be designed to allow for corresponding limitations of temperature rise.

All electrical equipment, the function and application of which is not immediately self-evident as judged by appearance, location or other indications shall be provided with nameplate, shall carry appropriate inscriptions, and, in the case of connection terminals and interior wiring devices, they shall carry identification markings.

All equipment shall be designed to operate satisfactorily with a momentary roll of 30 degrees to either side or a pitch of 10 degrees, a permanent list of 15 degrees to either side and a permanent inclination of 5 degrees fore and aft.



## 1.2 STANDARD VOLTAGE

<u>Item</u>	<u>Voltage</u>	<u>Cycle</u>	<u>Phase</u>	<u>Core Number of Cable</u>
Generators	450 V	60	3	3
Power	440 V	60	3	3
Lighting Panel Feeders	115 V	60	3	3
Lighting Panel Branch Circuits	115 V	60	1	2
Galley, Pantry and Laundry Apparatus	220 V	60	1 or 3	2 or 3
Nautical Instruments	440 V or 115 V	60	3 1	3 2
Radio Apparatus	440 V or 115 V	60	3 1	3 2
Interior Communication except next item	115 V	60	1	2
Reply bell, call bell, General Alarm, Emergency Light	22 V	DC		



## SECTION II

### ELECTRICAL CABLES AND CABLE INSTALLATION

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## SECTION II ELECTRIC CABLE AND CABLE INSTALLATION

### 2.1 CABLE CONSTRUCTION

All cables throughout the vessel to be constructed according to the requirement of American Bureau of Shipping and/or Japanese Industrial Standard (JIS) approved by A.B.S.

In general, multiple-conductor cable shall be used for power and lighting circuits. All phase wires of any circuit shall be contained in a single cable as far as possible. Single-conductor cables may be used for relatively short runs and confined to only one compartment.

Armor of single conductor cables, in general, to be of non-magnetic material.

All permanently installed cables for power branch circuits of little current capacity, lighting branch circuits exposed to moisture, interior communication systems, and motor control circuits shall be generally natural and/or butyl rubber insulated, impervious sheathed and basket weave armored cable, and lighting branch circuit cables in accommodation spaces, mess rooms, saloons, state rooms, etc., where not exposed to moisture shall be rubber insulated and basket weave armoured cable.

Impervious sheathed cable shall be used in wash rooms, toilets, shower rooms, and areas exposed to moisture or the elements.

Power feeders and generator cables shall be of the varnished cambric or butyl rubber insulated and impervious sheathed type.



In all machinery, refrigerated and cargo spaces, galley, laundry, stores, and open deck space, varnished cambric or butyl rubber insulated impervious sheathed cable shall be used. Bronze armored cable shall be used in the spaces where exposed to weather, except the protected cables with steel pipes.

Silicon rubber insulated, lead sheathed, heat resisting cable shall be used in all areas where the ambient temperature may exceed 70°C.

Heat and flame resistant type cable, suitably protected in sheath or tubing shall be used for direct connections to heat radiating or emanating parts in galley ranges, their controls and light fixtures on hood.

Cable to be used for portable hand lamps and cargo lamps.

## 2.2 INSTALLATION

Cables shall be run as directly as practicable, consistent with adequate ventilation of the cable wireways and with due care in the avoidance of certain hazardous locations such as; excessive heat areas, excessive wet or damp areas, magnetic compass areas, locations tending to expose the cables to mechanical damage, inflammable and explosion producing areas and in-accessible spaces.

If practicable, cables shall not be installed adjacent to piping of high temperature or other apparatus subject to leaks or condensation drips. When such conditions are unavoidable, suitable shielding shall be provided.



Cables shall be installed in such a manner as to prevent harboring of rats. Sharp bends shall be avoided as much as possible.

Cables shall not be grouped in excessively large banks except through wireway openings in beams or non-watertight bulkheads. Cables grouped in a single hanger should be limited preferably to double banking.

No cables shall be installed on gratings or walkways in engine room, bilges, or in spaces exposed to oil damage. If it is necessary to run cables under gratings or walkways, they shall be protected with galvanized steel pipes or supported on dripproof galvanized metal pans with side flanges turned down at least 1/2 inch.

All cables shall be continuous between outlet boxes, connection boxes, switchboards, panel boards, etc. Where armored cable enters any box or wiring device, the armor shall enter the box and be secured by a clamp or connector to assure good electrical grounding connection.

Cables installed on deck shall be run in galvanized steel pipes or in substantial channels of steel plate.

Electrical cable pipes or conduits on open deck or elsewhere shall have adequate drain's plugs and also inspection openings at frequent intervals.

### 2.3 WIREWAYS AND SUPPORTS

Cable supports shall be strong enough to withstand short circuit conditions.

Cables run in groups, shall be supported on metal hangers of not more than 18" spans in width, and spaced approximately



14" apart horizontally and 18" apart vertically, and so arranged to permit painting of the surrounding structure without disturbing the installation. Cables shall be securely strapped to the hangar without damage to the armor.

Cable hanger material shall be of steel flat strip not less than 1/16" thick, with galvanized steel with side flanges. Single or double runs may be supported by metal clips attached to the bulkhead by means of welded pads or studs. No attachments to watertight bulkheads or decks by means of rivets or bolts penetrating the bulkhead or deck shall be made.

Where cables pass through watertight bulkheads, watertight stuffing tubes shall be installed, where cables pass through watertight decks, kick pipes shall be used. Cables that pass through non-watertight bulkheads, beams, stiffeners, etc., an approved type of bushing shall be used, to protect the cables from chafing caused by vibration.

Where cables enter waterproof motors, control equipment or dripproof cabinets, approved watertight terminal or stuffing tubes shall be installed.

Where cables penetrate refrigerated space insulation, the continuity of the pipe shall be broken in the insertion of an insulating coupling of phenolic or similar material to minimize heat transfer and sweating of the pipe and adjacent bulkhead.

As a rule, in dining saloon, Owner's lounge, Owner's room, officers' state rooms, public accommodation, etc., cables running on the ceilings to be concealed behind the linings wherever the lining is installed for the ceiling,



but wherever the lining is not installed, the cables to be exposed. Cables running on the walls to be concealed behind the linings wherever the space is found better to install the cable, but wherever single plate is only installed or wherever not suitable to conceal the cable, the cables to be installed on the plates or on the steel structures without any covering for the cables.

All cable ends shall be sealed against the admission of moisture, air and oil. The conductor connections for power circuits shall preferably be connected to devices or buses by means of solderless terminal connectors. Solderless terminal connectors shall include means to prevent loosening due to vibration.

All cables shall be tagged with their identification marking at each point of connection and on both sides of decks and bulkheads..

#### 2.4 TESTING OF CIRCUITS

All lighting and power circuits shall be tested for insulation resistance between conductors and between each conductor and ground. The resistances recorded is to be not less than the values specified below for all lighting and power circuits:

Up to 5 Amp Load	2 megohms
Up to 10 Amp Load	1 megohm
Up to 25 Amp Load	400,000 ohms
Up to 50 Amp Load	250,000 ohms
Up to 100 Amp Load	100,000 ohms
Up to 200 Amp Load	50,000 ohms
Over 200 Amp Load	25,000 ohms



## 2.5 CABLE CALCULATIONS: POWER

The main generator circuits from each generator to its generator panel on the switchboard shall be calculated on the basis of 125 per cent generator full load current and the voltage drop shall not exceed 1 per cent.

The bus tie between the main switchboard and the auxiliary switchboard shall be calculated on the basis of 100% auxiliary generator full load current.

The feeder energizing group control boards, power panels, for energizing two or more motors shall be calculated on the basis of 125 per cent full load current of the largest motor plus the sum of the rated full load current of all other connected motors and 50 per cent of the installed spare circuit breakers or knife switches.

The feeder energizing power panels for commissary equipment, not including motor circuits, shall be calculated on the basis of 100 per cent of the rated current of the equipment supplied.

All branch circuits for motors shall be calculated on the basis of 125 per cent of the rated motor full load current and for commissary equipment 100 per cent.

Conductors for storage batteries to the point of distribution should be calculated from the maximum charge, or discharge rate of the batteries, whichever is the greater, and the voltage drop shall not exceed 1 per cent.

The shore connection feeder from the receiving outlet to the generator switchboard should be calculated on the basis of the required shore connection capacity and the voltage drop shall not exceed 2 per cent.



The voltage drop, based as calculated below, shall not exceed 5 per cent from the generator distribution switchboard bus to the most remote electric equipment.

The voltage drop for all circuits, or a section of a circuit shall be calculated by the following formulae:

(a) 2 - Conductor Circuit

$$\text{Percentage V.D.} = \frac{11 \times I \times 2L \times 100}{\text{CM} \times V} \quad (\text{For } 66,400 \text{ CM and smaller})$$

(b) 3 - Conductor Circuit

$$\text{Percentage V.D.} = \frac{1.73 \times 11 \times I \times L \times 100}{\text{CM} \times V} \quad (\text{For } 52,600 \text{ CM and smaller})$$

C. F. = Correction factor determined by system power factor and cable constants.

NOTE:

If voltage drop for an AC power circuit exceeds 5% as computed when using formulae (a) or (b), a more accurate determination of voltage drop shall be made by multiplying by a correction factor determined by system power factor and cable constants.

It is assumed that the resistivity of copper is 11.0 Ohms/ circular mil.ft. at 40°C. For all circuits emanating from or located in the engine room or other spaces rated at 50°C., the voltage drop shall be calculated on the basis of using 11.5 for the resistivity of copper.

The voltage drop caused by the inrush current of any motor may exceed 5 per cent provided that the voltage drop is not excessive to prevent the motor to start properly or cause unsatisfactory operation of other motors on the same feeders.



## 2.6 LIGHTING: CALCULATIONS

The voltage drop for lighting shall not exceed 3 per cent from the lighting bus of distribution switchboard to the most remote fixed receptacle or fixture.

Voltage drop for lighting circuits shall be calculated by Formulae (a) and (b) above.



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### SECTION III GENERATING PLANT

#### 3.1 MAIN SERVICE GENERATORS

The Mitsui made main ship's service generators shall be of the enclosed drip-proof self-excited type, self-ventilated, 450 volt, 3 phase, 60 cycle, AC, having maximum rated continuous capacity of 1000 kW at 0.8 power factor each. The generator shall be designed so as to maintain at least  $\pm 3$  per cent of rated voltage during operating conditions ranging between full load and no-load. Two units shall be furnished, complete with all appurtenances.

The voltage shall be self-controlled by static-exciting devices composed of potential transformer, saturable current transformer, reactor, metallic rectifier, etc.

The turbine generators shall be adjusted for parallel operation at all loads, but the parallel running with the diesel engine driven auxiliary generator shall not be arranged.

Generators shall have Class B insulation windings and shall be equipped with amortisseur windings.

Generators shall be installed with their shafts in a fore and aft position. The generators shall be located in the engine room, in a dry space, free from dripping liquids or oil.

In case that any steam relief valves are located below or adjacent to the main generators, the relief valves shall be fitted with sky or escape as necessary to prevent steam vapors from entering generator windings.

The generators shall be provided with suitable access covers for proper servicing. The generator terminals shall



be housed in a watertight enclosure, mounted at the side of the generator and arranged for top entry of cables. All generator leads shall be equipped with solderless terminal lugs for external connections.

The generators shall be fitted with a 115-volt electric heater to prevent condensation of moisture.

Search coils of thermometer shall be equipped in each main generator.

The generators shall have split sleeve type bearings, forced lubricated with lubricating oil pump attached to the prime mover.

The generator design shall be such that sleeves may be removed for replacement without removing rotor or driving coupling.

An interlocking switch arranged to be actuated in case of shutting down the prime mover on the overspeed and also on the loss of oil pressure shall be provided so as to trip the generator circuit breaker.

A pressure switch, located in the lubricating system and arranged to give an audible and visual alarm signal shall be provided.

Laminates for terminal boards, clamps, slot wedges and related applications shall be of the adequate type and the class of insulation consistent with heat and mechanical strength applied at the used point.

The prime mover for the generator shall be a separate type single reduction geared turbine.

The generator set shall be designed so as to be capable of sustaining 25 per cent overload of the generator rated output for two hours.



### 3.2 AUXILIARY GENERATOR

One set of Diesel driven 150 kW, 450 V, 3 phase, 60 cycle, alternating current generator shall be provided in the engine room for the purpose of boiler cold start, port use and restoration service in case of black-out of main generator.

The diesel shall be made by General Motors Co. The engine shall be air cooled and have a speed governor, over-speed trip and other safety devices as required by the Classification Society.

Generating set shall be equipped with an automatic engine starting control equipment of battery starting system.

The auxiliary generator shall be rated 150 kW, 450 V, 3 phase, 60 cycle, 0.8 power factor, continuous, be designed for an ambient temperature of 50°C and be enclosed self-ventilated dripproof type, without spark producing components (non commutator and slip-rings), and controlled the voltage by automatic voltage regulator of static type.

The generator and diesel engine to be mounted on a common bed plate.

The generator to be fitted with a 115-volt electric heater to prevent condensation.

It shall be so arranged that when the main generator voltage drops to about 80% of the rated voltage, the generating set can be started automatically within a few seconds. When the emergency voltage comes up about 90%, the electrical supply to be transfered from the main generator to the auxiliary generator. When the main generator voltage restores, the automatic transferring



system from the auxiliary generator's source to the main generator's source to work and the auxiliary generator to be automatically stopped.

It shall also be arranged so that in case of failure of the first automatic starting of auxiliary generator system, several automatic startings can be repeated, and if starting fails, the visual and aural alarms provided on the automatic starting panel are to signal.

### 3.3 SERVICE SWITCHBOARDS

#### 3.3.1 General

Description of switchboards in the following paragraphs, indicates the general type and arrangements required, the design shall be developed by the Builder as may be required to suit the final electric plant development of the ship. The Builder's ultimate development of these boards, number and ratings of circuit breakers, bus arrangement, connections and all other design development shall be subject to approval. The switchboards shall be as compact as possible consistent with good design and shall be of the dead front type.

#### 3.3.2 Switchboard Structure

All switchboards shall be designed for satisfactory operation in an ambient temperature of 50°C and shall be able to withstand the conditions of moisture and vibration prevailing in shipboard service.

The switchboards shall be of the dead front type, with totally enclosed switch gear; and shall be made up of a series of individual free-standing units bolted together to



form a complete structure.

The frame work of each unit shall be fabricated from steel angles, channels, or other structural steel shapes, or forged members. The top, bottom, and sides of each unit shall be formed by a length of structural steel shape or formed member. Vertical supporting members shall be provided for support of large circuit breakers and large disconnect switches. The top of the switchboard shall be provided with steel, drip-proof cover. Riveting shall not be used in the assembly.

Design of switchboard shall provide suitable space for wiring also space for terminal boards. Isolating barriers between units shall be easily removable to facilitate change in outgoing wiring.

The front panels for each unit shall be made from thick sheet steel. The flanges of all steel panels shall be welded at the corners, and ground smooth. Butt points on the panel surfaces shall not be permitted. Hinged panel sections shall be provided in front of all equipment, except molded case type circuit breakers and frame mounted rheostats, for ready access to the equipment. All hinged panels shall be provided with door stops positioning devices to stop the door in its opening swing, and hold it in the opening position. Concealed hinges shall be used throughout for fastening hinged panels to the switchboard structure. Captive thumb-screws shall be employed to secure hinged panels in the closed position.

All bolts nuts and washers shall be steel and suitably treated to resist corrosion. Lock washers or jam nuts shall be used throughout to prevent loosening of bolts.



All bolts used for structural purposes shall be of the standard hexagonal head type, of not less than 1/2" size, the maximum spacing shall be 20".

The metal surfaces of the switchboards shall be treated with a zinc-chromate primer and shall be finished with two coats of light gray on the outside and one coat on the inside surfaces.

### 3.3.3 Switchboard Enclosures

Enclosures made of reinforced expanded metal or wire mesh shall be provided at the ends of the switchboards extending to the ships structure equipped with doors arranged for locking.

All fuses mounted in the switchboard structure shall be accessible without removing any of the plates or grille work.

Each switchboard shall be equipped with grab rails so positioned to afford support to the operator from the pitch and roll of the ship while operating the board. The rails shall be made from smooth hardwood, non-conductive, 1-1/4 inch in diameter. Rails shall be installed so as not to interfere with the equipment, and shall extend not more than 10 inches from the front of the panel. Rails shall run in full length of the board.

Two horizontal rows of battens shall be provided on rear framework, one row shall be 2 feet above the deck, and the other 4-1/2 feet above the deck, to prevent personnel from coming in contact with live busses. Battens shall be removable and mounted on the face of the rear vertical members so as not to protrude beyond the ends of the structure.



The switchboards shall be arranged for top entry of cables.

#### 3.3.4 Switchboard Instruments

All switchboard instruments shall be new and of the latest design, and shall be constructed so that the entrance of dust and moisture will be at a minimum. Instruments shall be capable of withstanding the ship's vibration without fault or damage.

Instrument cases shall be made of metal, phenolic, or other suitable material. Metal cases and instrument parts shall be treated to resist corrosion before applying the final finish.

Instruments shall be properly calibrated after installation and aboard ship. Means to prevent loosening due to vibration shall be provided on each instrument stud for securing conductor to the instrument.

Separate shunts, where required, shall be used for each instrument, shunt ratings shall not be less than the ratings of the instrument, to which they are connected.

Meters and relays or operating coils shall not be connected to the same shunt. Potential and current transformers shall be used for instruments, meters, and relays connected to A.C. circuits over 220 volts and 30 amperes unless otherwise approved.

All meter cases mounted on deadfront switchboards shall be grounded and shall be of the semi-flush type. Instruments on the main switchboard and distribution switchboards shall be 6 inch rectangular type with arc scale or 4-1/2 inch



rectangular type with circular scale.

It shall be required that all switchboard indicating instruments be accurate to within 1.5 per cent of full scale deflection, with exception of the battery charging meters, which may be 2.5 per cent.

### 3.3.5 Circuit Breakers

All circuit breakers shall be capable of safely opening circuits carrying the maximum fault current obtainable at their points of application and carrying the maximum load of such circuits.

All circuit breakers shall be of the trip-free type. Molded case type circuit breakers shall be equipped with thermal-magnetic overload trips for operation in 50°C. ambient temperature. All circuit breakers of the molded-case type shall be mounted or arranged in such a manner that the breaker may be removed from the front without disconnecting the copper or cable connections or de-energizing the supply to the breaker.

All open frame type circuit breakers shall be of the ready access type and be equipped with a marking to indicate the "open" and "closed" positions of the breaker contacts.

Circuit breakers for steering gear feeder shall have instantaneous trip only.

A three pole, manually operated, disconnect switch shall be provided on the rear of the switchboard. Each main generator shall be provided with same.

Interrupting capacities for main generators' circuit breakers connected with reverse current trip to the main bus



shall be not less than 20,000 amperes, the breakers with back-up fuses on main bus for feeder circuits shall be not less than 40,000 amperes, and the breakers backed-up on the main switchboard and connected to the secondary distribution center or to the lighting bus shall not be less than 5,000 amperes.

Current limiting fuses which have characteristic of effective current limitation and high current rupturing ability, may be used on the feeder circuits emanated from main bus for the purpose of back-up protection of the molded-case type circuit breakers connected to main generator's bus, provided that suitable co-ordination with the circuit breakers can be obtained, in accordance with the recent practice for high fault current protection.

### 3.3.6 Bus Bars and Copper Connections

All buses and connections shall be bare and made of hard drawn, pure commercial copper, without barriers between circuits. Cable for this purpose shall be prohibited unless specifically approved.

All bus bar connections shall be provided with silver surfaces contacts, also the contact surfaces of studs and all devices to which connections are made shall be silvered surfaced.

Bus connections to individual feeder circuit breakers shall be designed on the basis of the frame rating of the breaker when the frame rating is 600 amperes or less, except connections to open-type breakers.

Bus supports shall be formed of high dielectric strength, low moisture absorption molded compound, with high impact strength and high creepage surface.

### 3.3.7 Control Switches

Control switches shall have round or oval handles unless otherwise specified. Clearly marked escutcheon plates to indicate their position shall be provided.



### 3.3.8 Relays

Relays which have sensitive characteristics and precision mechanisms, and/or adjustments shall be housed in moisture and dust proof cases, such as reverse powers relays, etc.

Auxiliary relays, alarms relays and similar devices which do not have such precision properties may only be provided with a cover.

### 3.3.9 Wiring

All switchboard wiring shall be of the standard type and be neatly formed and supported to the switchboard in such a manner to avoid chafing due to vibration. Bushings shall be provided where wires are installed through steel structures, or metal partitions. Terminal blocks shall be provided where required to facilitate ready wire disconnections.

### 3.3.10 Name plates

All switchboard devices shall be provided with phenolic name plates of black with white letters. Name plates for voltage coils on shunt, undervoltage and reverse power trips shall show voltage rating and the value of external resistance if used.

Rubber matting of high grade material shall be provided for the front of the switchboard, and rear of the switchboard.

## 3.4 MAIN SWITCHBOARD

### 3.4.1 General

The main switchboard shall comprise a series of panel



units for the control and protection of the two main generators, the power and lighting distribution circuits as may be required for the proper operation of the electric plant, including the shore connection and auxiliary switchboard bus tie feeders.

#### 3.4.2 Equipment

The switchboard equipment, the general arrangements of instruments, meters, control switches and other devices, circuit breakers, indicating lights, etc., shall be determined by the Builder.

The main generator panels shall include such equipment as, ammeters, voltmeters, wattmeters, thermometers, indicating lights, control switches, relays, potential transformers, current transformers and such other devices as required. Main circuit breakers shall also be included.

A synchroscope and synchronizing lamps shall be provided for parallel running.

A frequency meter, a power factor meter and change over switches shall be provided for main generators.

Two 3-lamp earth indicating systems for earth test, that is, one system for the 440-volt feeders and the other for the 115-volt feeders, to be provided, and to be of the metal filament type.

An ammeter and a voltmeter for A.C. 117-volt bus bar to be installed on the A.C. 117-volt feeder panel.

Spare feeder breakers for the capacity less than 100 amperes shall be mounted on the board the number to provide 10 per cent spares but not less than one breaker for each



frame size based on the number of active breakers required at the time of ordering the board.

### 3.5 AUXILIARY SWITCHBOARD

The auxiliary switchboard shall consist of a generator panel, 440 V feeder panels and 115 V auxiliary feeder panel.

The control panel for the auxiliary diesel generator shall be provided with a generator disconnecting switch, generator circuit breaker, voltmeter, frequency meter, ammeter, wattmeter and complete set of voltage regulating equipment.

The generator circuit breaker shall have instantaneous short circuit trip and overload trip operated with overload relays.

The auxiliary switchboard shall include bus transfer switches, a voltage relay for automatic bus transfer control, and a feedback tie breaker.

Automatic transfer switch to be so arranged that the electrical power can be transferred automatically from the main generator plants to the auxiliary generator plant in case any failure of the main generator plants occurs, and upon restoration of the bus tie feeder voltage the power supply can be transferred automatically from the auxiliary generator plant to the main generator plants, as stated in paragraph 3.2 Auxiliary Generator.

One feed back switch of molded case thermal type circuit breaker on the main switchboard to be provided for the purpose to feed back the electrical power of the auxiliary generator to the main switchboard.



Two 3-lamp earth indicating systems with test switch for earth test, that is, one system for the 440-volt feeders, and one for the 115-volt feeders, to be provided, and to be of the metal filament type.

Indicating lamps to be provided for the auxiliary generator's circuit, the bus tie feeder, etc.

Following loads to be supplied with the power from the auxiliary generator:

- Midship switchboard
- Steering gear
- Lubricating oil service pump
- Air compressor for control
- Fuel oil service pump
- Boiler room supply fan
- Auxiliary circulating pump
- Auxiliary condensate pump
- General service pump
- Automatic combustion control equipment
- Essential light panels
- Navigation lights indicator panel
- Gland exhaust fan
- Galley power
- Etc.

### **3.6 MIDSHIP SWITCHBOARD**

The midship switchboard to be of dead front type, and



to be installed in the electric room to supply the electrical power to the midship, the forecastle space, etc. The midship switchboard to have two bus tie feeders, that is, one from the main switchboard and the other from the auxiliary switchboard. One feeder selector switch to be provided to select one of two bus tie feeders.

The switchboard to consist of one or two feeder panels, and to have regular bus bar, and auxiliary bus bar for both A.C. 450-volt bus bar and A.C. 120-volt bus bar respectively. All the loads on the regular bus bar to be dropped from the midship switchboard, leaving the loads on the auxiliary bus bars when the auxiliary generator supplies the power to this switchboard.

The midship switchboard shall include an ammeter, a voltmeter, ammeter and voltmeter selector switches for each phase of 115-volt bus, ground detector lamps for 115-volt bus, transformer tie breakers, 440 V and 115 V feeder circuit breakers.

### 3.7 STORAGE BATTERIES

An emergency lighting and inter-communication system shall be installed, using two sets of 200 A.H., 24 volt storage batteries of lead-acid type as the source of supplying the power.

An auxiliary generator set shall be provided with one set of lead-acid type storage battery of about 200 A.H., 24 volts for the diesel cranking.

A separate rectifier type unit shall be provided for the charging of each kind of the batteries. The rectifier



shall be of the selenium cell, convection cooled type. The equipment shall be mounted in a dry location, free from moisture and in a space secluded from tampering by unauthorized personnel.

The equipment shall be complete with adjustable tap transformers and other components required to accomplish high rate charging of the batteries.

Trickle charging equipment shall be provided for the emergency lighting batteries as well as the starting batteries.

The rectifier shall be capable of charging either of the batteries in not more than 8 hours, and shall be rated on the basis of 50°C ambient temperature.

The equipment shall consist of and include a charging ammeter, a discharging ammeter, a voltmeter and control switches as required.

### 3.8 TRANSFORMERS

Transformers shall be air cooled, single phase 60 cycle, dry type, suitable for continuous duty, marine service and designed for operation in ambient temperatures as determined by the location of same. Wiring compartments shall have suitable provisions for making cable connections. Both primary and secondary windings shall be delta connected.

Transformers shall be of dripproof enclosure, and provided with conduit knockouts for cable entrance.

The transformer requirements shall be one bank of transformers consisting of three single phase, 60 cycle, transformers with primary and secondary windings.



The transformers to be as follows:

a) For ordinary lighting system aft, etc.:

Three (3) 15-kVA 450/117-volt single-phase transformers to be provided, and installed in the engine room. The transformers to be fed from the main switchboard.

b) For essential lighting system aft, etc.:

Three (3) 10-kVA 450/117-volt single-phase transformers to be provided, and installed in the emergency generator room. The transformers to be fed from the auxiliary switchboard, and to be normally energized from the main generating set.

c) For galley equipment:

Three (3) 30-kVA 450/225-volt single-phase transformers to be provided, and installed in the approved place. The transformers to be fed from the main switchboard.

d) For lighting system amidships, nautical equipment, etc.:

Three (3) 10-kVA 450/117-volt single-phase transformers to be provided, and installed in the electric room on upper deck. The transformers to be fed from the midship switchboard, and to be normally energized from the main generating set, and in case of emergency to be energized from the auxiliary generator set.

The primary side voltage of the transformers in items (a), (b), (c) and (d) to be capable of adjustment at 460, 450 and 440 volts respectively. The tap changing for the adjustment of the secondary side voltage, as required, to be performed on the primary side winding.



### 3.9 TEST PANEL

Testing panel to be arranged for testing of the lamp bulbs, fuses, electrical apparatus, etc.

The panel to be of dead front type and wall mounting type, and to be installed in the electric work shop.

The following instruments or devices to be provided:

- 3 - Molded case thermal type circuit breakers  
(one each for A.C. 440 V, A.C. 110 V and D.C. 24 V)
- 1 - A.C. voltmeter with selector switch for A.C. 440 V and A.C. 110 V
- 1 - D.C. voltmeter for D.C. 24 V
- 2 - Receptacles (one each for water-proof type and non-water-proof type)
- A suitable number of lamp sockets for lamp test
- 1 - Furse tester with a neon lamp

### 3.10 SHORE CONNECTION

A shore connection box with a capacity of A.C. 3-phase, 500 amperes, 440 volts to be installed at a suitable position in the aft accommodation space convenient for bringing the portable cables in from the shore source.

The shore connection box to be of watertight and wall mounting type and consist of a molded case type circuit breaker, a phase sequence indicator with accessories to check 3-phase conductors connection, terminals of ample size, etc.

The terminals in the box shall be permanently marked for current phase sequence and provided with approved solderless connectors for the temporary cables.



On the main switchboard, a molded case thermal type circuit breaker, 500 amperes for both frame rating and long time delay overcurrent trip rating, to be equipped. The circuit breaker to be electrically interlocked with the feed back switch on the auxiliary switchboard and the air circuit breakers for the main generators.

### 3.11 PANELBOARDS

#### 3.11.1 General

440 V power panels to be equipped with three or two-pole molded-case type circuit breakers of frame size not less than 50 amperes and not less than 5,000 amperes interrupting capacity.

115 V distribution panels for lighting, small power and nautical instruments of considerable capacity to be fitted with two-pole (or three-pole) molded-case type circuit breakers of not less than 30 ampere frame size and adequate interrupting capacity.

Interior communicating and instruments distribution panels of 115 V. A. C. and 22 V. D. C. may be equipped with a fuse on each pole.

#### 3.11.2 Construction

Panelboards shall be of dripproof construction and shall be of the deadfront type with the number of circuits required by the ship's approved lighting and power plans. Panelboards in damp or wet locations shall have watertight cable entrances.

All ferrous parts shall be corrosion resistant. Insulating materials shall be of laminated or molded phenolic.



Porcelain or slate insulation shall not be used.

Lighting panel buses shall be three wire as required and branches shall be two wires. Connections in the main bus shall be allocated in such a manner as to maintain a balanced three wire system. Busses in power panels shall be designed to suit the application.

All the main bus bars shall be rigidly fastened to the base at both ends and the main cable terminals shall be of the two-hole or equivalent type to prevent turning. Main bus bars shall be fabricated from commercially pure copper not less than sectional area required by the AIEE No. 45 paragraph 17.17 and the Table 32.

Solderless terminals of the pressure bar type shall be provided by the manufacturer in the mains for all branch circuits. All contact surfaces on lugs, studs, bus bars, etc., shall be silver plated.

Lighting panels shall be provided with at least one spare circuit breaker complete, installed but not used, for each ten active units installed or fraction thereof. Power panels shall be provided with at least one spare circuit breaker complete, installed but not used, for each ten active units installed or fraction thereof.

Non-watertight cabinets shall be of folded type construction with all seams continuous welded and without knockouts. The maximum cabinet height shall be 45 inches as practicable. The cabinet boxes and fronts shall not be thinner than #14 gauge sheet steel.

Cabinet boxes shall be so designed that no sheared or sharp edges, including doors, shall have a radius of



approximately 1/6 inch. Doors shall have a flange around all sides, including inner door openings, and all corners shall be welded and ground smooth. Non ferrous hinges shall be used for doors. Doors for lighting cabinets shall be provided with a catch device.

Panel boards installed in location accessible to unauthorized personnel or outsiders shall be provided with locks and keys where they are liable to cause serious troubles due to tampering.

Each cabinet shall contain two or more steel straps welded into the back of the cabinet for mounting cabinet to bulkhead.

After fabrication the cabinet shall be painted with one coat of zinc-chromate primer followed by a finish coat of approved gray marine paint.

A directory shall be installed on the back of each cabinet inner door to identify circuits therein. Directory cards and data thereon shall be furnished by the Builder.

A name plate shall be installed beside each power panel switching unit. A name plate shall also be installed on the face of each cabinet.

### 3.12 PROTECTIVE ELECTRICAL DEVICES

All circuit breakers shall be selected in accordance with the Classification Society.

Circuit breakers used in local distribution panel shall be marine type molded case, quick break, with inverse time tripping characteristics on overloads and instantaneous trip device for short circuits.



Power circuit breakers shall also be quick make. All panel circuits breakers shall be designed to operate in an ambient temperature of 50°C.

The protective functions of circuit breakers on switchboards, panels, or controllers shall be selected and arranged so as to isolate any fault in the power distribution resulting in the least portion of the system's service being interrupted.

### 3.13 ELECTRIC WIRING EQUIPMENT

In general, except where otherwise specified, the electrical installations shall be non-watertight construction. Watertight and/or explosion proof fittings shall be installed in all areas subject to wet, damp, or weather exposed areas and spaces where explosive materials are used or stored.

Non-watertight boxes, cabinets and enclosing cases shall be of dripproof construction, except that in certain living spaces, such as state rooms. Where specifically approved, installations need not be dripproof.

Receptacles and switch receptacles of the three-pole grounded type shall be installed, for use in plugging in portable equipment. The receptacles and receptacle plugs shall be of a type that can be plugged in only one position to insure ground connection throughout. Receptacles shall be locally grounded.

Watertight plugs shall be of the pin protected type with metal shell completely covering the pin.

Unless otherwise specified, all receptacles junction and fuse boxes mounted in spaces exposed to weather shall be made of brass, bronze, or anodized aluminum.



## SECTION IV

### MOTORS AND CONTROLS

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## SECTION IV MOTORS AND CONTROLS

### 4.1 GENERAL

All motors and controllers shall be of the marine type and shall conform to all requirements of the regulatory bodies as listed in Section I. Motors in general shall be of the squirrel-cage, induction type.

Motors and controls shall be capable of operating successfully when tilted continuously 15 degrees athwartship and 5 degrees fore and aft or when ship rolls 30 degrees port or starboard. All equipment shall be capable to operate successfully under vibration incidental to normal marine service.

All equipment shall be new and installed so as to be readily accessible for repairs or removal. Motors shall be of the same manufacture so far as possible.

Waterproof metal enclosures and lead sheathed or impervious sheathed wiring shall be used in all locations subject to condensation of vapors and in locations either temporarily or permanently exposed to the elements.

Motors shall be provided with corrosion resistant name plates bearing such information as: Manufacturers' type and frame designation, rated output, temperature rise limit, design ambient temperature, revolutions per minute at rated load, voltage, amperes at rated load, phase, frequency and time rating. Motors shall be of continuous duty rating unless otherwise specified.

Foundations shall be provided and designed to hold vibration to a minimum.



#### 4.2 MOTORS

In general, motors shall be designed for 440 volts, 3 phase, A.C. except where otherwise specified on Builder's plans.

Motors of 0.2 kW or smaller shall be designed for 115 volts, single phase, 60 cycle, A.C. Motors shall be semi-enclosed dripproof or waterproof, as the location requires.

All motors shall be equipped with anti-friction bearings designed to take the required thrust and radial loads. The ball bearings may be of Japanese make (N.S.K. or N.T.N.), but shall be interchangeable with American S.K.F. Standard bearings. Fractional HP motors less 0.2 kW may have sleeve bearings.

For all motors except where Shield bearings are used, pressure grease fittings, grease seals and relief plugs shall be generally equipped. Where direct connected pressure fitting and relief plugs would be inaccessible, they shall be extended by means of 1/8" pipe. Round frame motors shall be provided for axial flow and propeller fans.

#### 4.3 CONTROLS

Enclosures for all motor controllers shall be fabricated from steel and treated with corrosion resistant material. Enclosures shall be of dripproof, rodent proof design and also of dustproof where required. Each controller enclosure shall have a manually opening door and shall be provided with a name plate describing its rating and functional purpose.

All motors of 1.5 kW or larger shall have magnetic type, push button control. The controller shall be equipped with



a disconnecting switch, manually operated.

The branch circuit switch or circuit breaker on the distribution panel or switchboard may serve as the disconnect device if it is in the same compartment with the motor controller.

For engine room auxiliaries and other applications group control boards as required may be provided.

In grouped motor control arrangements, the disconnecting means shall be so interlocked with the hinged door of the associated motor controller as to prevent the controller door from being opened while the circuit is energized.

The reduced voltage type starter shall be used for motors above 37 kW operated by 150 kW auxiliary generator at boiler cold starting and main-power restoration service, and for motors above 150 kW.

The motors corresponding to the above are shown hereinafter.

Steering gear motors

Forced draft fan motors

The across-the-line type starter shall be used for all other motors.

Sequence starting system to be provided, that is, the following motors to be automatically and in sequence restarted in case of restoration of supply voltage after voltage failure, taking some time after restoration.

The following motors to be of the sequence starting system:

Auxiliary condensate pump

Auxiliary circulating pump



Steering gear  
Lubricating oil service pump  
Fuel oil service pump  
Gland exhaust fan  
Air compressor for control  
(in pressure switch control)

The above-mentioned motors to be supplied from the auxiliary generator, and the under-mentioned motors to be supplied from the main generators:

Drain transfer pump  
Main condensate pump  
Main circulating pump  
Forced draft fan

Controllers for the fresh water pump, drinking water pump, sanitary pump, control air compressor, ship service air compressor and refrigerator compressor shall be provided with an "Automatic-Manual Control".

All multiple speed motors shall be so designed that they can be switched from low speed to high speed and viceversa without being stopped.

The starters of multiple speed motors of large size such as motors for forced draft fans and main circulating pump shall be so arranged that high speed running is achieved not directly to high speed but through low speed running during time delay period.

Where in addition to the main power, a secondary source of power above 24 volts is brought into a motor controller for alarm, indicating light or other circuits, suitable interlock shall be provided to disconnect the secondary source upon opening the controllers' disconnect switch.



Thermal overload relays shall be compensated for change in temperatures. Motor controls shall in all cases be capable of interrupting the stalled motor current.

Ammeters in general shall be provided on the controller cabinets for motors of essential service and not less than 11 kW.

A complete wiring diagram of the motor controller shall be attached to the inside of the cabinet door.

#### 4.4 STEERING GEAR MOTOR CONTROL

A dripproof panel to provide manual transfer of the steering gear motors and auxiliary equipment between the two steering gear power feeders shall be installed in the steering gear machinery space.

Each steering gear power feeder from the main switchboard and auxiliary switchboard shall be connected to a bus in the panel. The busses shall be connected to switches for energizing the steering gear motors and auxiliary steering equipment. The switches shall be arranged to permit connection of either steering gear motor to either power feeder and shall be mechanically interlocked. The switch for auxiliary steering equipment shall be fused on the load side.

#### 4.5 LUBRICATING OIL PUMP MOTOR CONTROL

Preparation to be so arranged that the lubricating oil pump selected as standby will start automatically on failure of another pump motor operated.

This arrangement will not prevent restarting of the operated motor on reestablishment of main circuit from its



failure condition.

#### 4.6 EMERGENCY STOP

An emergency stop device for fuel oil pumps, and forced draught fans, shall be provided in the passageway leading to the engine room.

An emergency stop device for machinery space ventilating fans shall be provided in the passageway leading to the engine room.

Emergency stop devices for ventilating fans outside the engine room shall be provided in wheel house and at a suitable location in after quarters preferably same as the location of the emergency stop for engine room ventilating fans.

Each emergency stop device to have a single push button shall be able to stop the motors simultaneously.

Adjacent to the glass enclosure for emergency stop, a small hammer shall be provided for breaking glass fixed in a clip.

Remote emergency stop switch for pumps which discharge overboard in way of life boats, to be provided.

#### 4.7 REMOTE CONTROL

For fuel oil service pumps and forced draught fans remote start-stop push buttons shall be provided adjacent to the boiler gauge board.

For main circulating, auxiliary circulating, main condensate and auxiliary condensate pumps remote start-stop push buttons shall be provided adjacent to the main gauge board.



They shall be fitted on adjacent part of the engineers' signal and alarm panel adjacent to main or boiler guage board, preferably assembled with the signal and alarm panels.

#### 4.8 TURNING GEAR MOTOR CONTROL

The control for turning gear motor shall be so arranged to prevent operation when the supply of lubrication oil to main propulsion unit is cut off, except for operation during gear inspection.

#### 4.9 AUTOMATIC CUT-OUT SWITCHES

The forced draft fan and boiler room ventilation fan circuits are equipped with automatic cut-out switches actuated by CO<sub>2</sub> fire fighting system.

The engine room supply and exhaust fans should also be equipped in like manner.



SECTION V  
LIGHTING EQUIPMENT

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## SECTION V LIGHTING EQUIPMENT

### 5.1 GENERAL

The amount of foot-candle power illumination for any particular space and use, shall be approved by the Owner. In general the lighting fixtures and accessories shall be designed in accordance with the Japanese Industrial Standards (JIS) and meet all requirements of the Classification Society.

All lighting fixtures, switches, receptacles, etc., installed in the engine room, machinery spaces, deck houses, lavatories, bath rooms, galley, pantry, store room spaces and any outside areas exposed to weather, shall be of the marine, watertight type.

Generally the major part of the lighting fixtures shall be surfaced mounted, unless otherwise specified. Fixtures and accessories in officers' quarters and public rooms shall be flush mounted and all wiring shall be concealed as much as practicable. Power for lighting system shall be 115 volt, 3-phase, 60 cycle, 3 wire to distribution panels and 2 wire, single phase, 115 volt, 60 cycle for branch circuits.

### 5.2 ILLUMINATING LAMPS AND HOLDERS

Generally, illuminating lamps in the living quarter shall be of the fluorescent type, with the exception of ceiling fixtures in the wheel house, chart room, and lavatories & W.C. Tubes of the fluorescent lamps shall be of American standard size. Illuminating lamps in the machinery space, open deck, and out passaveways, etc. shall be of the incandescent type.



Lamp holders for incandescent lamps shall be: EDISON medium screw, type E-26, for lamps up to and including 200 watt capacity; Edison E-39 Goliath screw type for lamps over 200 watt capacity; Standard Edison type E-26 or E-12 for indicating and signal lights.

### 5.3 MACHINERY SPACE LIGHTING

Watertight, marine type incandescent lamp fixtures shall be installed in the engine room and other machinery spaces. Lamp capacity shall be 60 watt, 100 watt or 200 watt as required or specified. Two (2) 300 watt, vapor-proof type floodlights for illumination of the upper portion of the main engine located in the engine casing shall be provided.

Plug receptacles in the engine room and other machinery spaces, shall be of the three-pin, grounded type. Switch shall be marked to indicate "ON" and "OFF" position. All switches and receptacles installed in the aforementioned spaces shall be watertight marine type.

A suitable number of fixed lights shall be provided in the engine room, under the lower floors for lower level glass and bilge well.

Light fixtures with adjustable shades, shall be installed in the work-shop, over work benches, lathes, vises, etc.

### 5.4 ACCOMMODATION LIGHTING

In officers and crews living quarters and public rooms, ceiling fixtures that are suitable and that match the surroundings shall be provided, that is:



Decorated fluorescent ceiling lamps to be provided in the dining saloon, captain's day room, Owner's lounge, chief engineer's day room and chief officer's day room, and to be of an approved luxury design comparable to a first class passenger cabin type. Lighting shall be fully adequate and conveniently placed.

20-watt x 2, non-watertight fluorescent ceiling lamps to be provided in captain's bed room, Owner's bed room, chief engineer's bed room, chief officer's bed room, mess room, recreation room and officer's living rooms.

20-watt x 1 or 20-W x 2 non-watertight fluorescent ceiling lamps to be provided in the crew's living rooms, pantry, radio room, etc.

100 W x 1 or 60 W x 1, non-watertight incandescent ceiling lamps to be provided in wheel house and chart room.

60 W x 1, watertight ceiling incandescent lamp to be provided in lavatories, W.C.s, etc.

All ceiling fixtures shall be controlled by means of wall switches located close to entrance and adjacent to the door jamb.

A 15-watt fluorescent desk lamp of suitable design shall be installed for each living room desk. In cases where the desk is backed to the bulkhead, the lamp or fixture shall be of the wall mounted type and fastened permanently to the bulkhead. Over each berth there shall be installed an 8-watt fluorescent berth light of suitable design. An 8-watt watertight fluorescent mirror lamp shall be fitted on over each lavatory mirror and a 15-watt non-watertight fluorescent mirror lamp shall be fitted on over each mirror.

Each fluorescent light shall be fitted with a line filter condenser of a type and design which will filter out all line noise and prevent interference with the vessel's radio station and private radios.



At least one (1) duplex receptacle in each Owner's and Officer's room. Crews quarters shall be provided with one (1) receptacle.

In the Owner's, Captain's and Chief Engineer's bed rooms, the ceiling fixtures shall be controlled by a 2-way switches, one located at the door and the other within convenient reach of the bed.

Lighting fixtures in the passageways shall be of 60 W x 1, non-watertight incandescent lamp. Stairways shall be provided with stairway lights, so designed to throw light down the stairs and eliminating any upward illumination.

Three (3) 40-watt incandescent chart table lamps shall be provided for chart tables together with respective dimmer switches, one in wheel house two in chart room. Chart lamp shall be of movable arm type with shade and the dimmer switch shall be suitable for 60 watt lamp.

#### 5.5 OPEN DECK PASSAGEWAYS

All open deck passages shall be illuminated by the use of 60 W x 1, watertight incandescent deck or bulkhead fixtures. Deck lights to have independent circuits so that they may be turned off on the panel board without affecting other lights.

#### 5.6 REFRIGERATED SPACES

Refrigerated spaces shall be illuminated by watertight fixtures and protected by metal wire guard. Switches



located adjacent to and on the outside door. Each compartment to have a separate switch with an indicating light at the main door.

#### 5.7 ACCOMMODATION LADDERS

Accommodation ladder lighting shall be arranged so as to be obtained by the life boat launching lights or deck flood lights. If such arrangement is impossible, a portable accommodation ladder light may be used which is provided for each ladder.

#### 5.8 LIFE BOAT LAUNCHING

Four (4) watertight, 300 watt, marine type flood lights for use of launching life boats shall be provided. Lights shall be protected by a metal wire guard, and installed so as to swing inboard or outboard as required.

#### 5.9 CHAIN LOCKER

The chain locker shall be illuminated by two (2) watertight fixtures, with metal guard; lamp shall be 100 watt. Control switch (watertight) shall be located outside of access.

#### 5.10 PAINT ROOM

Fixtures for the paint room shall be of the explosion proof, pendant type. Switch to be located outside of access.



#### 5.11 BATTERY ROOM

Fixtures for the battery room shall be the same as those listed for the paint room and switch location the same.

#### 5.12 CARGO OIL PUMP ROOMS, TWEEN DECK SPACE

The cargo oil pump rooms and tween deck space shall be illuminated by explosion-proof pendent lamps of 200 watt approved type. The control switches for these lamps are located in safe space adjacent to the pump rooms and tween deck space.

#### 5.13 DECK FLOOD LIGHTS

All flood lights shall be, watertight, marine type and shall be connected by means of flexible cord wiring and three pin, grounded plug receptacles shall be provided.

Ten (10) 500-watt flood lights for deck illumination shall be provided; two (2) on the foremast, two (2) on the navigation bridge deck fore, three (3) on the navigation bridge deck aft and three (3) on the boat deck fore.

One (1) 250-watt flood light of the watertight, marine portable type shall be provided on the boat deck aft.

All flood lights shall be controlled from the wheel house.



#### 5.14 CARGO LIGHTING

Six (6) portable cargo lights of explosion proof construction and three (3) water-proof portable cargo lights shall be provided for use of cargo spaces and shall be of 200 watt intensity.

#### 5.15 FUNNEL (STACK) LIGHTING

Two (2) 250 watt, watertight, marine type flood lights shall be provided for funnel lighting.

Inside the funnel there shall be installed a number of lights and receptacles. Lights inside the funnel shall be controlled by a switch located inside the funnel.

#### 5.16 PLUG RECEPTACLES

Plug receptacles shall be installed at convenient positions throughout the ship for portable lights and other appliances and receptacles are to be of the three (3) pole, pin type with one pole grounded. Owner shall designate the position or locations of the receptacles to suit conditions.

#### 5.17 SWITCHES

All switches in connection with lighting circuits shall be double pole linked type unless otherwise specified. All deck receptacles shall be equipped with switches as an integral part of same. "ON" and "OFF" positions shall be clearly marked on each switch.



#### 5.18 PORTABLE LIGHTS

Twenty (20) 40-watt watertight portable lamps with guard shall be provided in the engine room, boiler room, steering engine room, deck machinery rooms and vicinity of deck machinery and life boat.

And about seven (7) non-watertight portable lamps with guard shall be provided in the radio room, gyro room, motor room, wheel house, machine shop and stores.

Six (6) 60-watt heavy-guarded portable lamps of explosion-proof construction with extension cord shall be furnished for the special purposes on deck.

#### 5.19 WATER COOLER PLUG RECEPTACLE

A water cooler receptacle shall be provided in the engine room and also two in after quarter and one in the midship.

#### 5.20 EMERGENCY LIGHTING

A 24 volt DC, 200 AH battery emergency lighting system shall be provided.

Emergency lights as required shall be provided in the engine room, boiler room, wheel house, radio room, gyro room, chart room, steering gear room, Captain's, Owner's and Chief Engineer's state rooms, dining saloon, officer's mess, crew's mess room, quarters' passageways and any other spaces requiring emergency lighting.

In event of failure of the main 115 volt lighting system, it shall be arranged for automatic transfer to the emergency lighting system.



Each lamp required in the emergency lighting system shall be 20, 10 or 5 watt intensity so as to match the location and shall be identified by red paint marking.

A manual test switch shall be provided in the emergency lighting system, and marked indicating normal and test position.

#### 5.21 SAFETY LAMP

Two (2) dry-cell type flash lights of flame-proof portable type shall be furnished.



## SECTION VI

### NAVIGATING AND SIGNAL LIGHTS

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## SECTION VI NAVIGATING AND SIGNAL LIGHTS

### 6.1 RUNNING AND ANCHOR LIGHTS

The normal complement of running lights controlled from an automatic tell-tale panel located in the wheel house shall be provided and installed under International Navigation Rules.

Two (2) fixed anchor lights of an approved type shall be provided and installed, one forward and one aft, with control from a switch in the wheel house.

Navigation lights shall be installed to meet the requirements of Navigation rules and shall be located on the foremast, aftermast, stern and port and starboard sides of the ship, control to be from an audible and visual five-way tell-tale panel in wheel house.

These lights shall be of watertight construction of the two lamp type and operate from a 115 volt AC power supply. Three wire, watertight, grounded receptacles shall be provided at each location.

### 6.2 SIGNAL LIGHTS

A portable Aldis type daylight morse signalling lamp with a 12 volt battery shall be provided.

Provisions for a Morse, marine type signal light of 115 volt, 60 cycle rating with four (4) 20 watt lamps shall be mounted on a mast structure above the compass bridge deck and shall be controlled by two (2) Morse telegraph keys in the wheel house.



One set of portable, marine type Suez Canal signal lights, 115 volt, 60 cycle AC 40 watt lamps consisting of four (4) red lamps, three (3) white lamps, and one (1) green lamp shall be provided. Two (2) portable "Not-Under-Command" lights shall be provided. A red warning light of 115 volt, 40 watt shall be mounted on radar mast to show when cargo oil is being loaded or unloaded, and controlled from the wheel house.

#### 6.3 CONNECTION BOX OF SUEZ CANAL SEARCHLIGHT

A connection box of AC 115 volt supply shall be provided at the bow of the ship for the use of Suez Canal searchlight, which is considered to be 115 volt, 2 to 3 kW. (The searchlight shall not be furnished by the Builder.) The Suez Canal searchlight to be controlled by the switch in wheel house.

#### 6.4 SEARCHLIGHT

One (1) 1-kW watertight incandescent searchlight of manual operated type shall be provided on compass bridge deck and it shall be capable of being substituted for daylight signalling lamp.



## SECTION VII

### INTERIOR COMMUNICATION EQUIPMENT

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## SECTION VII INTERIOR COMMUNICATION EQUIPMENT

### 7.1 GENERAL

Navigational equipment and other instruments located in the wheel house shall be equipped with dial illumination with dimmer control.

Equipment in the aforementioned spaces shall be located according to approved ship plans.

All relays used in any interior communication equipment shall be of the unit or self-contained type, complete on its own base.

Each chassis, rack or cabinet shall be at ship's ground potential.

### 7.2 TELEPHONE SYSTEM

A nine (9) station, selective ringing, common talking, sound powered telephone system shall be provided. Marine type equipment shall be used throughout, equipment shall be new.

Wall type telephones shall be installed for wheel house, engine room and steering engine room.

Desk type telephone shall be provided for the Captain's day room(extensive to bedroom), the Chief Engineer's day room(extensive to bedroom), Chief Officer's day room, 1st Engineer's room, Dining Saloon, and Officers' mess room.

The engine room telephone shall be provided with a hood to reduce noise to a level whereby normal telephone conversation is possible.



The engine room requires a bell relay and signal light in addition to the telephone set.

### 7.3 LOUD SPEAKER SYSTEM

A loud speaker system shall be provided, employing the standard loud-speaker microphone arrangement. The audio amplifier bank shall be capable of delivering a 15 watt output, with the receiving and transmitting switches mounted in the wheel house. Two (2) talk-back type with microphones shall be installed on the poop deck aft, forecastle; three (3) loud-speakers of talk-back type for crew's mess room, petty officers' mess room and boatswain's room. Operating control shall be in the wheel house.

A sound-powered type telephone hand set with extension cord and a plug to be furnished at each microphone site, and to be utilized through the microphone circuit separated from amplifier with a control switch and by interchanging with the microphone.

### 7.4 CALL BELL SYSTEM

Two (2) sets of call bell indicator with indicating lights and bell and operating on AC 110 volt shall be provided and installed in the officers' mess pantry and saloon pantry.

From Captain's day and bed rooms, Captain's study, Owner's bed room, Owner's lounge, Pilot room, Chief Officer's day and bed rooms, Chief Officer's office, Dining Saloon and Radio Operator's room to Saloon Pantry.



From Chief Engineer's day and bed rooms, First Engineer's day room, Engineer's office, Officer's mess room, Officer's recreation room and each bed in Hospital to Officer's mess pantry.

7.5 CALL BELL (REPLY BELL) SYSTEM

A bell system for signalling between the wheel house and the engine room shall be installed. This system shall operate on 22 volt DC battery supply.

7.6 GENERAL ALARM SYSTEM

A general alarm system consisting of manually operated contact makers in wheel house, engine control station, boiler room and poop deck passage while in the after house arranged to sound bells provided in the chart room, engine room, boiler room and living quarters to be installed.

The engine room shall be provided with a small siren instead of a bell.

The system shall operate on 22 volt DC battery supply.

7.7 ENGINEER'S ALARM SYSTEM

A manually operated "lock-in" type contact maker on or near the main gauge board in the machinery space, arranged to sound two strong buzzers in the Engineer's passageway shall be provided.

7.8 REFRIGERATOR SPACE ALARM SYSTEM

The refrigerator space alarm system shall consist of a buzzer located in the galley, a bell in the engine room and a push-button fitted to the main refrigerator door.



## 7.9 ENGINEER'S SIGNAL AND ALARM SYSTEM

The following indicating signal and alarm system shall be provided on the main gauge board.

- 1) A steering gear alarm indicator shall be fitted in wheel house.
- 2) A warning light indicator that the turning gear is in the engaged position shall be provided on the main gauge board. There shall be two coloured lamps, one lamp green for clutch-off, one red for clutch-in.
- 3) An engineer's central signal & alarm panel for visual signals and audible alarms by motor siren shall be provided immediately adjacent to the engine control station.

The panel shall be equipped with the followings:

### Failure Alarms:

- a) Steering gear motor st'bd overload and no volt
- b) " " port " "
- c) Low level of lubricating oil gravity tank st'bd
- d) " " " port
- e) Low pressure of main lubricating oil
- f) Low pressure of main generator's lubricating oil No.1
- g) " " " No.2
- h) Control air pressure failure
- i) Boiler room gauge board alarm system
- j) Wrong maneuvering for engine telegraph

### Indication of operating conditions with aural alarm:

- a) Main circulating pump
- b) Main condensate pump No.1
- c) Main condensate pump No.2



- d) Auxiliary circulating pump No.1
- e)       "                       "               No.2
- f) Auxiliary condensate pump No.1
- g)       "                       "               No.2
- h) Lubricating oil pump               No.1
- i)       "                       "               No.2
- j) Steering gear                       No.1
- k)       "                       "               No.2
- l) F.O. service pump                   No.1
- m)       "                       "               No.2
- n) Drain transfer pump               No.1
- o)       "                       "               No.2
- p) Forced draft fan                   No.1
- q)       "                       "               No.2
- r) Gland exhaust fan

- 4) A boiler room signal and alarm panel with visual and audible alarm (by the Buzzer) shall be provided immediately adjacent to the boiler gauge board.  
(Alarm for boiler burning system shall be combined on boiler guage board separated from other alarms.)

The panel board shall be equipped with the followings:

Failure alarms:

- a) Fuel oil pressure failure
- b) Fuel oil cut-off Nos. 1 & 2
- c) Boiler water high level, port & stbd.  
(See "Machinery Specification")
- d) Boiler water low level, port & stbd.
- e) Boiler economizer fire alarm



Indication of operation condition with aural alarm:

- a) Forced draft fan Nos. 1 & 2
- b) Fuel oil service pump Nos. 1 & 2
- c) Boiler room supply fan Nos. 1 & 2

#### 7.10 BROADCAST AERIAL SYSTEM

Two (2) sets of multi-coupler antenna system of Japanese make to be provided, one for the midship accommodation and the other for aft accommodation. The system to be of AC 60 cycle, single phase, 115 volt.

Each system to consist of a skyrod antenna unit, an antenna amplifier, a required number of outlet couplers for the radio, the necessary connecting cables, etc.

In the midship accommodation, the outlet coupler for the radio to be arranged in such rooms as stated below:

- Each living room
- Captain's study
- Owner's lounge
- Dining saloon

In the aft accommodation, the outlet coupler to be arranged in such rooms as stated below:

- Each living room
- Officers' mess room
- Officers' recreation room
- Crew's mess room
- Hospital

The radio sets not to be furnished by the Shipyard.



#### 7.11 WHISTLE AND WHISTLE CONTROL SYSTEM

One (1) air tyfon and one steam tyfon and controllers for same shall be provided. This apparatus shall be of standard type of Kockums manufacture. The air tyfon shall be type TA 150/110 (super tyfon) and the steam tyfon shall be type T425 DVEL.

One steam tyfon shall be installed on the funnel and one air tyfon shall be mounted on the fore mast.

The steam phone mounted on the funnel shall be electrically and manually operated, and the one mounted on the fore mast shall be electrically operated. A heating element shall be provided for the tyfon that is mounted on the fore mast.

The whistle control system shall consist of solenoid operated valves at the whistle, a time controller box, signal change over switch box and three pushbuttons located in the wheel house and on the bridge wings.

The timing contactor shall have provisions for automatic timing of 40 seconds, one minute and two minute periods.

#### 7.12 ENGINE ORDER TELEGRAPH SYSTEM

An electric engine order telegraph system of self synchronous type, AC 115 volt, single phase, shall be installed and include:

One (1) - Transmitter (with reply) for wheel house, of 30 cm dial, double face, pedestal type with a bell.

The unit to be of eleven orders, and its dials to be marked as follows:



Ahead	{ Full	Astern	{ Dead slow
	{ Half		{ Slow
	{ Slow		{ Half
	{ Dead slow		{ Full

Standby

Stop

Finished with engine

Its internal illumination lamp to be equipped with dimmer switch capable of adjusting the brightness.

Two (2) - Transmitter (with reply) for both bridge wings, of 30 cm dia, pedestal type with a bell and equipped with a strip heater or silica-gel for preventing moisture condensation.

One (1) - Indicator (with reply) for engine control station, of 40 cm dial, single face, bulkhead mounting type, and equipped with electric gong.

One (1) - Indicator (no reply) for boiler control station, of 30 cm dial, single face, bulkhead mounting type, and equipped with electric bell.

Provisions to be made for the throttle wrong maneuvering alarm. A visual and aural alarm to be provided both in the wheel house and in vicinity of the engine control station.

A visual and aural alarm to be provided for power failure alarm in the wheel house. Power for the alarm to be fed from 24-volt storage battery.

The above mentioned each transmitter to have an engaged signal lamp and a push-button for interchanging. And these three transmitters to be electrically interlocked and interchanged with each other on the electric relay system.



#### 7.13 CO2 FLOODING ALARM

One set of alarm device for CO<sub>2</sub> flooding system shall be provided, that is, interlock switches on the CO<sub>2</sub> bottle valves for CO<sub>2</sub> flooding system in engine room, boiler room and main pump room, each one alarm siren in engine room and boiler room, and one bell for pump room.

#### 7.14 BRIDGE INTER-COMMUNICATOR SYSTEM

One set of the bridge inter-communicator shall be furnished.

The bridge inter-communicator shall consist of three (3) speakers with microphones and one (1) control box; one (1) in the wheel house and one (1) each on navigation bridge wings.



## SECTION VIII

### INSTRUMENT AND NAVIGATING EQUIPMENT

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## SECTION VII INSTRUMENT AND NAVIGATING EQUIPMENT

### 8.1 GENERAL

All metallic parts of electrical navigating equipment shall be suitable for marine use. Suitable precautions shall be taken to prevent electrolytic action between dissimilar metals either where aluminum is used in contact with steel or when unavoidable it is used with other metals.

All equipment, including wiring, shall be marine type impervious to the extremes of temperature and humidity encountered on board ship including tropical and freezing conditions and shall not operationally be affected when tilted at an angle of 5 degrees fore and aft and 15 degrees athwartship.

Unless otherwise specified, the equipment fed from the ships power supply shall operate satisfactorily with a variation in voltage of plus or minus 5% and a variation in frequency of plus or minus one cycle.

### 8.2 SHAFT REVOLUTION INDICATOR SYSTEM

A shaft indicator system, complete with all necessary appurtenances shall be provided. It shall be designed to withstand moisture and vibration and shall be properly calibrated for accuracy after installation. The equipment shall consist of a transmitter, DC generator, and four indicators; one (1) indicator, showing both direction and r.p.m., with revolution counter, to be installed at the main gauge board, and one (1) indicator each, showing both direction and r.p.m., without revolution counter, to be installed in the wheel house and both bridge wings.



A disconnecting switch shall be provided so as to enable isolating the indicators on bridge wings from the wheel house indicator.

Revolution indicators fitted on bridge wings shall be provided with strip heaters with attached instructions indicating when strip heaters are in service.

### 8.3 ELECTRIC TACHOMETER INDICATORS

Electric tachometer indicators for cargo oil pumps shall be provided in safe space adjacent to main pump room on main deck so as to be seen through gastight glass port from upper part in pump room.

### 8.4 RUDDER ANGLE INDICATOR

An electric self-synchronous rudder angle indicator system capable of accurately indicating the position of the rudder shall be installed. The system shall include a transmitter in the steering gear room and each one indicator in the wheel house and both bridge wings.

A disconnecting switch shall be provided so as to enable isolating the indicators on bridge wings from the wheel house indicator.

Rudder angle indicators fitted on bridge wings shall be provided with strip heaters with attached instructions indicating when strip heaters are in service.

### 8.5 ELECTRIC THERMOMETER

Electric Thermometers shall be provided as follows:

- 1) A temperature indicator with selector switch to



be provided on main gauge board for H.P. turbine steam chest and maneuvering valve.

- 2) A temperature indicator with selector switch shall be provided for boilers on boiler gauge board. Measured points are as follows:
  - a) Superheater outlet
  - b) Desuperheater (boiler drum) outlet
  - c) Uptake
  - d) Air heater outlet

#### 8.6 SALINITY INDICATOR

In addition to the salinity indicator system supplied for the evaporating plant, a salinity indicator shall be installed for the main and auxiliary condensate systems. The indicating instruments shall be contained in a salinity indicating panel fitted adjacent to the engine control station. The indicators may be of Japanese make of good quality.

The panel shall be equipped with alarm lights and an audible alarm indicating an excessive concentration of chlorine. The salinity indicator shall satisfactorily measure concentrations of chlorine from 0 to 10 grains per gallon.

Each salinity indicator system for evaporating plant to have a dump valve located in distillate cooler discharge and a cell located in distiller condenser drains of each stage, salt water heater tube nest drains and air ejector condenser drains.



For the main and auxiliary condensate systems, salinity cells shall be installed at the following locations:

- a) Condensate from main condenser (main condensate pump discharge)
- b) Condensate from auxiliary condenser (auxiliary condensate pump discharge)
- c) Low pressure steam generator feed (L.P.S.G. feed pump suction)
- d) Drain outlet of drain collecting tank (drain transfer pump discharge)

#### 8.7 ECHO DEPTH SOUNDER

An echo depth sounder system of Japanese make shall be provided. It shall be capable of giving visual and recorded indications of the depth of water below the keel between 2 and 240 fathoms.

The visual indicator shall be located in the wheel house and the recorder in the chart room. Two Transducers shall be located, one in the forward pump room and the other at the forward part in the engine room.

The echo depth sounder shall be furnished by the Builder.

#### 8.8 PRESSURE LOG

One complete set of pressure log of Japanese make shall be provided and installed.

The log mechanism shall be fitted at the bottom of forward part in engine room, and the distance and speed



indicator in the chart room, the speed indicator in the engine room, complete with all necessary wiring connection.

Additionally the log shall be equipped with indicating lights installed in the chart room and the engine room, which will indicate the position of the pitot tube; that is, red light when pitot tube extended and green light when pitot tube is retracted. The indication shall be performed by a switch interlocked with position of the pitot tube.

The rated supply voltage of this set to be 115 volt, 60 cycle.

#### 8.9 GYRO COMPASS AND GYRO PILOT

One complete set of Sperry gyro compass equipment of U.S.A. make with auto pilot shall be provided and consist as followings:

- One (1) master gyro compass

- One (1) compass control panel with accessories

- One (1) motor-generator

- One (1) steering repeater at gyro pilot steering stand

- Six (6) bearing repeaters, one at radio direction finder, one at radar, one on compass bridge deck, one on each wing of navigation bridge and one in steering engine room

- One (1) course recorder

- One (1) two-unit gyro pilot system

And rated supply voltage of motor-generator and pump unit shall be 440 volt, 60 cycle, 3 phase AC.



SECTION IX

RADIO EQUIPMENT

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## SECTION IX RADIO EQUIPMENT

### 9.1 RADIO TELEGRAPH EQUIPMENT

The radio telegraph equipment shall be of JRC marine radio console unit (Model NMT-292) of the highest class Japanese maker who has a mutual technical service agreement with Mackay Radio Telegraph and Telephone Co., Inc., U.S.A., as well as International Marine Radio Co., England.

The following radio equipment shall be provided, complete with antennas and accessories and meeting all regulatory body rules. Radio equipment shall be supplied from a separate 115 volt, single phase, 60 cycle AC from the midship switchboard.

One (1) - 250 watts main transmitter (High and Medium frequency)

One (1) - 40 watts emergency transmitter

One (1) - main receiver

One (1) - emergency receiver

One (1) - radio telephone adapter equipment including a remote unit for use with the main transmitter. The remote unit shall be installed in the Captain's day room.

One (1) - automatic alarm receiver

One (1) - automatic alarm signal keyer

One (1) - power supply unit

One (1) - portable life boat radio set complete with accessories

One (1) set - Accessories:

motor-generator, battery, battery charger, antenna and other necessary apparatuses



## 9.2 RADIO DIRECTION FINDER

One set of automatic visual radio direction finder of the highest class direction finder maker, Koden Electronics Co., Ltd., in Japan, Mod. No. KS-262-UR, shall be provided.

The radio direction finder shall be of marine type, whose maker has a mutual technical service agreement with Mackay Radio Telegraph and Telephone Co., Inc., U.S.A., as well as International Marine Radio Co., England.

The receiver-indicator with gyro repeater shall be provided in chart room and loop antenna shall be provided on the wheel house top.

The radio direction finder shall be designed that when the dial of the receiver is turned to a signal, a propeller-shaped image appears on the screen of the cathode ray tube, instantaneously indicating the direction or bearing of the signal, and sense is determined by merely pushing a button.

## 9.3 RADAR

Two sets of marine radar of Raytheon type of U.S.A. make shall be provided, that is, one large radar (Raytheon Model 1450) and one small radar (Raytheon Model 1500).

Two indicators shall be installed in the wheel house, transceiver in the chart room and two scanners on the radar mast.



9.4 POWER UNIT FOR SUEZ CANAL RADIO TELEPHONE

One set of DC 6-volt power source equipment for Suez Canal radio telephone shall be provided, and each one receptacle shall be fitted on both bridge wing bulwarks.

Power unit of input AC 115-volt / output DC 6-volt 5A with a receptacle shall be fitted on after wall in the wheel house.

9.5 LORAN

One set of Sperry type loran of Japanese make shall be provided; the indicator shall be installed in the chart room.



## SECTION X

### SPARE PARTS

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## SECTION X SPARE PARTS

### 10.1 GENERAL

Spare parts shall be furnished in accordance with the recommendations of the regulatory bodies as listed below.

The spare parts shall be suitably packed in boxes and stored at dry places.

### 10.2 GENERATORS

Field coil	2 for every type machine
Bearing and bearing lining with oil ring	1 for every 4 or less
Bearing lubricant seal	1 for every 4 or less
Brush holder with spring	1 for every 10 or less
Brush holder stud insulation	1 set for one brush spindle for every 10 or less
Brush holder spring	3 for every 10 or less
Brush	Whole working number
Spare heater element (if necessary)	1 for every 4 or less (max. 4)
Selenium rectifier element	1 set for every type and rating
Resistor element	1 set for every type and rating
Special spanner	1 set

### 10.3 MOTORS AND CONTROLLERS

Bearing	1 for every 4 or less
Controller spring (except for overload relay)	1 for every 4 or less



Operating or shunt coil except current coil	1 for every 10 or less
Contact (except for overload relay)	1 set & 50% for first 100 plus 1 for every additional 10
Resistor element	1 for every 10 or less
Non-renewable fuse	Whole working number
Renewable fuse:	
Fuse element	Whole working number
Fuse carrier	1 for every 10 or less
Heater element for thermal type overload relay	1 for every 10 or less (min. 2)
Contact and spring for plunger type overload relay	1 for every 10 or less
Lens for pilot lamp	1 for every 10 or less
Bulb for pilot lamp	2 for every 1
Control switch or push button	1 for every type and kind

#### 10.4 SWITCHBOARD AND PANEL BOARD

Contact subject to burning and wear	Same number for first 10, plus 1 for every additional 10 or less
Spring	Same as above
Voltage coil	1 for every rating and type
Induction type protective relay	1 complete set for every 10 sets or less
Contact, spring and coil for control relay (plunger or armature type)	1 for every 10 or less



Molded case circuit breaker with interchangeable trip element	1 complete trip element assembly for every 10 identical trip element assemblies or less
Molded case circuit breaker with non-interchangeable trip element	1 complete set for every 10 sets or less (for every identical trip element)
Resistor element	1 for every 4 or less (max. 4)
Current limiting fuse	1 for every 1
Non-renewable fuse	2 for every 1 (max. 30)
Renewable fuse:	
Fuse element	2 for every 1 (max. 30)
Fuse carrier	1 for every 10 or less (max. 12)
Lens for pilot lamp	1 for every 10 or less
Bulb for pilot lamp	2 for every 1

#### 10.5 NAVIGATION AND SIGNAL LIGHT EQUIPMENT

Bulb for navigation and signal lights	2 for every 1
Bulb for pilot lamp for indicating device	2 for every 1
Bulb for day signalling light	5 for every rating & type
Bulb for searchlight	5 for every 1
Bulb for Suez Canal search- light	5 for every 1
Color slide for side light	Whole working number



Lens for pilot lamp for indicating device	1 for every kind used
Globe for signal light	1 for every kind used
Front glass for day signalling light	Whole working number
Relay for indicating device fuse	1 for every kind used (same as for switchboard)

#### 10.6 LIGHTING FITTINGS AND FIXTURES

Fluorescent tube	Whole working number
Incandescent bulb	Whole working number
Front glass for floodlight	2 for every kind used
Lamp globe	1 for every 10 or less
Tube socket	1 for every 10 or less (min. 2)
Bulb socket	1 for every 10 or less (max. 10)
Glow lamp	1 for every 2 or less (min. 2)
Glow socket	1 for every 10 or less (min. 2)
Ballaster	1 for every 10 or less (min. 2)
Condenser	1 for every 10 or less (min. 2)
Switch for controlling of lighting branch circuits:	
Non-watertight	5 for all
Watertight	2 for all



Toggle switch	1 for every 10 or less
Receptacle with switch (watertight)	2 for all
Plug (non-watertight)	10 for all
Plug (watertight)	5 for all

#### 10.7 BATTERIES

Connection bar with bolts and nuts	1 for every 10 or less
Filler cap	1 for every 10 or less

#### 10.8 COMMUNICATION AND NAUTICAL EQUIPMENT

Telephone equipment	To be supplied according to makers' standards
Nautical instrument	do.
Electronic apparatus	do.
Bell, buzzer, small siren, etc.	do.



## SECTION XI

### ELECTRIC OUTFITS

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## SECTION XI ELECTRIC OUTFITS

### 11.1 GENERAL

The following electric instruments, tools, outfits and materials for repairs and maintenance to be provided and properly stowed.

### 11.2 ELECTRIC INSTRUMENTS AND TOOLS

Megger (500 volt DC)	1
Portable ammeter	1
Portable voltmeter	1
Circuit tester	2
Test lamp	5
Side cutting plier	2
Jack knife	2
Screw driver	1 set of assorted sizes
Portable electric torch	2
Small electric soldering iron	1
Grease projector	1

### 11.3 OUTFITS FOR BATTERY EQUIPMENT

D.C. voltmeter with cadmium electrode	1
Liquid syringe	2
Hydrometer	6
Liquid syringe for hydrometer	2
Thermometer (alcohol)	4
Funnel	2
Distilled water (18-liter bottle)	2



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Jack knife	2
Screw driver	1 set of assorted sizes
Portable electric torch	2
Small electric soldering iron	1
Grease projector	1

### 11.3 OUTFITS FOR BATTERY EQUIPMENT

D.C. voltmeter with cadmium electrode	1
Liquid syringe	2
Hydrometer	6
Liquid syringe for hydrometer	2
Thermometer (alcohol)	4
Funnel	2
Distilled water (18-liter bottle)	2



11.4 MATERIALS FOR REPAIRS AND MAINTENANCE

Black tape	5 rolls
Rubber tape	2 "
Varnish cambric tape	2 "
P.V.C. tape	12 "
Sealing compound	5 pounds
Cabtyre cord	30 meters